CLAIMS

1. An inspection apparatus (70, 700) for inspecting an object of inspection by irradiating the object of inspection with either one of charged particles or an electromagnetic wave, comprising:

a working chamber controllable into a vacuum atmosphere for inspecting an object of inspection;

a beam generating means for emitting either one of the charged particles or the electromagnetic wave as a beam;

an electronic optical system wherein a plurality of beams is guided to irradiate the object of inspection held in the working chamber, and secondary charged particles generated from the object are detected and led to an image processing system which forms an image based on the secondary charged particles;

a data processing system for displaying and/or memorizing a state information of the object based on output of the image processing system; and

a stage system for holding the object so as to be movable relative to the beam.

2. The inspection apparatus of claim 1 comprising a transfer mechanism for holding the object and for transferring the object into or out of the working chamber.

3. The inspection apparatus of claim 2, wherein the transfer mechanism comprises the working chamber containing the stage system and being capable to be controlled in the vacuum atmosphere, and a loader for supplying an object of

inspection on the stage system in the working chamber, and wherein the working chamber is supported on a floor via a vibration isolator for isolating vibrations from the floor.

4. The inspection apparatus of claim 1 further comprising a voltage applying system for applying voltage to the object of inspection in the working chamber; and an alignment control device for controlling alignment by observing a surface of the object of inspection in order to position the object relative to the electronic optical system.

5. The inspection apparatus of claim 1, wherein the electronic optical system comprises an objective lens and an E x B separator, forms a plurality of beams to irradiate the object, and includes an optical system for accelerating secondary charged particles emitted by irradiation of the beams through the objective lens, separating the particles by the E x B separator, and projecting an image of secondary charged particles, and a plurality of detectors for detecting the image of secondary charged particles.

6. The inspection apparatus of claim 3, wherein the loader comprises a first loading chamber and a second loading chamber, each being separate from the other and arranged so as to control atmosphere of its inside; a first transferring unit for transferring the object of inspection between the inside of the first loading chamber and the outside thereof; and a second transferring unit disposed at the second loading chamber for transferring the object of inspection between the inside of the first loading chamber

and the stage system; wherein the inspection apparatus is further provided with a mini-environment space partitioned for feeding the object of inspection to the loader.

7. The inspection apparatus of claim 1, further comprising a laser interferometer for detecting coordinates of the object of inspection on the stage system; wherein the coordinates of the object of inspection are determined by utilizing a pattern present on the object of inspection with the alignment control unit.

8. The inspection apparatus of claim 6, wherein the alignment of the object of inspection includes rough alignment to be performed within the mini-environment space and alignment in the XY-directions and in the direction of rotation to be performed on the stage system.

9. A method for manufacturing devices comprising the step of detecting a defect on a wafer during a manufacturing process or after manufacturing process using the inspection apparatus of any one of claims 1 to 8.

10. An inspection apparatus (1000) for irradiating charged particles to a sample and for detecting secondary charged particles emitted from the sample, comprising:

at least one primary optical system for irradiating the sample with a plurality of charged particle beams; and

at least one secondary optical system for leading the secondary charged particles to at least one detector;

wherein the plurality of the charged particle beams are irradiated each at a position separated by distance resolution of the secondary optical system.

11. The inspection apparatus of claim 10, wherein the primary optical system has a function of scanning the charged particle beams at a distance greater than the interval of irradiation of the charged particle beams.

12. The inspection apparatus of claim 10, wherein an electric field for accelerating the charged particle beam is applied between a first stage lens of the secondary optical system and a surface of the sample, and the secondary charged particle emitted from the surface of the sample at an angle smaller than at least 45 degree passes through the secondary optical system.

13. The inspection apparatus of claim 10, wherein: the plurality of the charged particle beams are delivered generally perpendicularly to the surface of the sample; and

the secondary charged particles are deflected with the E x B separator and separated from the primary optical system.

14. A method for manufacturing devices comprising the step of detecting a defect on a device using the inspection apparatus of any one of claims 10 to 13.

15. An inspection apparatus (2000) wherein a sample is placed on an XY-stage so as to be moved to an optional position in a vacuum atmosphere, and a charged particle beam is irradiated on a surface of the sample, and wherein the XY-stage has a non-contact supporting mechanism with a hydrostatic bearing and a vacuum sealing mechanism by differential exhausting, a conductance reducing partition is disposed between a location where the surface of the

sample is irradiated by the charged beam and a hydrostatic bearing supporting portion of the XY-stage, and a pressure difference is generated between a region of irradiation of the charged particle beam and the hydrostatic bearing supporting portion.

16. The inspection apparatus of claim 15, wherein the partition contains a differential exhaust structure.

17. The inspection apparatus of claim 15, wherein the partition is provided with a cold trap function.

18. The inspection apparatus of claim 15, wherein the partition is disposed at two locations, one being in the vicinity of the position of irradiation of the charged particle beam, and the other being in the vicinity of the hydrostatic bearing.

19. The inspection apparatus of claim 15, wherein a gas to be fed to the hydrostatic bearing of the XY-stage is nitrogen or an inert gas.

20. The inspection apparatus of claim 15, wherein a surface of the XY-stage facing at least the hydrostatic bearing is subjected to surface processing to reduce a gas to be emitted.

21. An inspection apparatus for inspecting a defect on the surface of a semiconductor wafer by using the inspection apparatus of claim 15.

22. An exposure apparatus for delineating a circuit pattern of a semiconductor device on a surface of the semiconductor wafer or a reticle substrate by using the inspection apparatus of any one of claims 15 to 20.

23. A manufacturing method for manufacturing a semiconductor by using the inspection apparatus of any one of claims 15 to 20.

24. A inspection apparatus (3000) for inspecting a defect of a sample, comprising:

an image acquisition means for acquiring an image of a plurality of inspection regions that are displaced from each other while partially overlapping with each other on the surface of the sample;

a memory means for storing a reference image; and

a defect deciding means for determining a defect of the sample by comparing an image of each of the plurality of the inspection regions acquired by the image acquisition means with the reference image stored in the memory means.

25. The inspection apparatus of claim 24, further comprising an electronic optical system (3100) for discharging a secondary charged particle beam from the sample by irradiating each of the plurality of the inspection regions with the primary charged particle beam;

wherein the image acquisition means is adapted to acquire an image of each of the plurality of the inspection regions one after another by detecting the secondary charged particle beams emitted from the plurality of the inspecting regions.

26. The inspection apparatus of claim 25, wherein the electronic optical system (3100) is provided with a source of particles for discharging primary charged particles and a deflecting means for deflecting the primary charged

particles; and

the plurality of the inspection regions are irradiated one after another with the primary charged particles emitted from the source of the particles by deflecting the primary charged particle with the deflecting means.

27. The inspection apparatus of any one of claims 24 to 26, further comprising: a primary optical system for irradiating the sample with a primary charged particle beam; and a secondary optical system for guiding the secondary charged particles to a detector.

28. A method for inspecting a defect on a wafer during a processing or as a finished product using the inspection apparatus of any one of claims 24 to 26.

29. An inspection apparatus (4000) comprising:

a primary electronic optical system for irradiating a surface of a sample by a plurality of primary charged particles; and

a secondary electronic optical system for leading a secondary charged particles emitted from each point of irradiation by the plurality of the primary charged particles formed on the surface of the sample to a secondary electron detector after separation from the primary electronic optical system by accelerating the secondary charged particles by means of an electric field applied between an objective lens and the surface of the sample, converging the secondary charged particles accelerated, and separating the secondary charged particles

from the primary optical system by an E x B separator disposed between the objective lens and a lens of the objective lens at the side of a beam generating means;

wherein the primary electronic optical system is configured in such a manner that points of irradiation by the primary charged particles are formed on the surface of the sample in a two-dimensional way, and that points of the irradiation points projected in one-axial direction are located at equal intervals.

30. The inspection apparatus of claim 29, wherein the plurality of the primary charged particle beams are arranged so as to minimize a maximum value of a distance between optional two points out of the points of irradiation formed two-dimensionally on the surface of the sample.

31. An inspection apparatus (4000) having a primary charged particle beam irradiation device for irradiating a surface of a sample with a plurality of charged particle beams; and a secondary charged particle detector for detecting secondary charged particles respectively from points of irradiation by the plurality of the primary charged particle beams formed on the surface of the sample, wherein the secondary charged particles from a predetermined region on the surface of the sample are detected while transferring the sample;

wherein the primary charged particle beam irradiation device is arranged in such a manner that the points of irradiation by the primary charged beams to be formed on

the surface of the sample are disposed in rows N in a direction of transferring the sample and in columns M in a direction perpendicular to the direction of transferring the sample.

32. The inspection apparatus of claim 31, wherein the primary charged particle beam irradiation device comprises a beam generating means, an aperture plate having a plurality of apertures adapted to form a plurality of charged particle beams, the beams being formed by containing particles generated by the beam generating means to form irradiation points disposed in rows N in a direction of transferring the sample and in columns M in a direction perpendicular to the direction of transferring the sample, and the apertures are located within a range of a predetermined electron density of the charged particles emitted from the beam generating means.

33. The inspection apparatus of claim 32, wherein each of the points of irradiation by the primary charged particle beams is scanned by; (a distance between the columns) / (number N of the rows) + α in a direction perpendicular to the direction of transferring the sample, where α is a minimal distance.

34. The inspection apparatus of any one of claims 29 to 33, wherein a secondary electron beam detected by a secondary electron beam detector is used for performing a measurement including measuring a defect of the sample surface, measuring a line width of an integrated circuit formed on the surface of the sample, and measuring a

voltage contrast or measuring precision of alignment.

35. The inspection apparatus of claim 32 or 33, wherein the primary charged particle beam irradiation device is provided with a beam generating means and a plurality of primary charged particle beam irradiation systems, each primary charged particle beam irradiation system being adapted to form a plurality of points of irradiation with primary electron beams on the surface of the sample and the aperture plate and to prevent the primary electron beam of each primary electron beam irradiation system from interfering with the primary electron beam of the other primary electron beam irradiation system; and wherein a plurality of the secondary electron detectors are disposed so as to correspond to each of the primary electron beam irradiation systems.

36. An inspection apparatus (4100) comprising: a primary optical system having a single beam generating means for irradiating output beam to an aperture plate with a plurality of apertures and for irradiating charged particles passed through the plurality of apertures on a sample, wherein the secondary charged particles generated from the sample are separated from the primary optical system by an E x B separator, and the separated secondary charged particles are delivered into a plurality of detectors so as to be detected through a secondary optical system having at least one stage lens.

37. An inspection apparatus (4100) comprising: a primary optical system having a beam generating means with an

integrated cathode for irradiating output beam to an aperture plate with a plurality of apertures and for focusing and irradiating beams passed through the plurality of apertures on a sample surface, wherein the secondary charged particles generated from the sample are separated from the primary optical system by an E x B separator, and the separated secondary charged particles are delivered into a plurality of detectors so as to be detected through a secondary optical system having at least one stage lens.

38. An inspection apparatus (4100) for irradiating a beam emitted from a beam generating means to an aperture plate having a plurality of apertures to produce images of the plurality of the apertures, delivering the plurality of the images to a sample, separating the secondary charged particles generated from the sample from a primary optical system to deliver the secondary charged particles into a secondary optical system, and enlarging the secondary charged particles by the secondary optical system to project to a surface of a detector

wherein a single aperture plate is disposed in a position deviated toward the side of the source of the electron beam from the position of an image of the beam generating means formed by a lens of the primary optical system, and the position of the single aperture plate in the direction of the optical axis thereof is disposed so as to minimize the difference in beam strength of the beams to be delivered from each aperture to the surface of the sample.

39. An inspection apparatus (4100) for irradiating a beam emitted from a beam generating means to an aperture plate having a plurality of apertures to produce images of the plurality of the apertures, delivering the plurality of the images to a sample, separating the secondary charged particles generated from the sample from a primary optical system to deliver the secondary charged particles into a secondary optical system, and enlarging the secondary charged particles by the secondary optical system to project to a surface of a detector, wherein a single aperture plate is disposed in a position deviated toward the side of the beam generating means from a position of an image of the beam generating means formed by the primary optical system, and wherein an amount of deviation is set so that an amount of detection of the secondary charged particles obtained when a sample with no pattern is disposed on the surface of the sample minimizes a difference thereof between the plurality of the apertures.

40. A manufacturing method for manufacturing a device wherein a wafer on the way of a manufacturing process is evaluated by using the inspection apparatus of any one of claims 36 to 39.

41. An inspection apparatus (4200) for irradiating a beam emitted from a beam generating means to an aperture plate having a plurality of apertures, projecting and scanning a reduced image of the primary charged particles passed through the plurality of the apertures by using a primary optical system on a sample, and enlarging the secondary

charged particles emitted from the sample by a secondary optical system to project them into a detector, wherein the positions of the plurality of the apertures are disposed so as to correct a distortion of the primary optical system.

42. An inspection apparatus (4200) for irradiating a first multi-aperture plate having a plurality of apertures with beams emitted from one or more beam generating means, projecting and scanning a reduced image of the primary charged particle beams passed through the plurality of the apertures on a sample by using a primary optical system, and enlarging by a secondary optical system the secondary charged particles emitted from the sample to detect them using a detector having a plurality of detecting elements, and including a second multi-aperture plate with a plurality of apertures disposed in front of the detector;

wherein the positions of the apertures formed in the second multi-aperture plate are arranged so as to correct a distortion in the secondary optical system.

43. An inspection apparatus (4200) for irradiating a beam emitted from a beam generating means to an aperture plate having a plurality of apertures, projecting and scanning a reduced image of primary charged particles passed through the plurality of the apertures on a sample by using a primary optical system, and projecting images of secondary charged particles emitted from the sample by a secondary optical system to a detector, wherein shapes of the plurality of the apertures are set so as to correct field astigmatism of the primary optical system.

44. An inspection apparatus (4200) adapted to acquire image data in a multi-channel by irradiating an aperture plate having a plurality of apertures with beams emitted from beam generating means, projecting and scanning reduced images of charged particles passed through the apertures thereof on the sample with a primary optical system including an E x B separator, and projecting images of the secondary charged particles emitted from the sample on a detector by means of an imaging optical system;

wherein the images of the secondary charged particles are formed on a deflecting main plane of the E x B separator at the sample side, and images of the primary charged particles from the plurality of the apertures are formed on the deflecting main plane of the E x B separator.

45. A method for manufacturing devices wherein a wafer in the process of being manufactured is evaluated by using the inspection apparatus of any one of claims 41 to 44.

46. An inspection apparatus (4300) having a primary optical system containing a beam generating means for discharging charged particles, an aperture plate with a plurality of apertures, a plurality of lenses, and at least two E x B separators disposed in a spaced relationship with each other, the primary optical system being adapted to irradiate the surface of a sample to be inspected by the beam emitted from the beam generating means, and a secondary optical system for separating secondary charged particles emitted from the sample from the primary optical system by one of the at least two E x B separators, and

delivering and detecting the secondary charged particles in secondary charged particle detectors;

wherein an image of each of the plurality of the apertures is formed by irradiating the aperture plate with the charged particles emitted from the beam generating means, a position of the image of each of the plurality of the apertures thereof is aligned with a position of each of the E x B separators, and directions of the charged particles deflected by electric fields of the E x B separators are arranged to be inverse from each other, when looked from on the sample surface.

47. The inspection apparatus of claim 46, wherein the primary optical system and the secondary optical system are disposed in two rows and in plural columns so as to prevent a path of secondary charged particles deflected by one of the E x B separators from interfering with a path of the secondary charged particles deflected by the other E x B separator.

48. An inspection apparatus (4300) having a primary optical system containing a beam generating means discharging a beam, an aperture plate with a plurality of apertures, a plurality of lenses, and an E x B separator so as to irradiate a surface of a sample to be inspected with the beam emitted from the beam generating means, and a secondary optical system for separating secondary charged particles emitted from the sample from the primary optical system by the E x B separator, and delivering and detecting the secondary charged particles in a secondary charged

particle detector;

wherein an image of each of the plurality of the apertures is formed by irradiating the aperture plate with the beam from the beam generating means, and a scanning voltage is superimposed on an electric field of the E x B separator so as to have the beam deflect.

49. The inspection apparatus of claim 46 or 48, wherein the primary optical system and the secondary optical system are disposed in two rows and in plural columns so that paths of the secondary charged particles deflected by the E x B separator do not interfere with each other.

50. A method for manufacturing devices wherein a wafer during a manufacturing process is evaluated by using the inspection apparatus of claim 49.

51. An inspection apparatus (4400) adapted to irradiate a sample with a primary charged articles by a primary optical system, delivering secondary charged particles emitted from the sample by an E x B separator after the particles pass through an objective lens into a secondary optical system, thereafter increasing a distance between secondary charged particle beams by at least one stage of lens, and detecting the secondary charged particle beams by a plurality of detectors,

wherein at least three different energizing voltages are separately supplied to the objective lens so as to detect at least three data which represent rising widths of electric signals corresponding to strength of the secondary charged particles and which are obtained when a pattern

edge parallel with a first direction is scanned in a second direction.

52. The inspection apparatus (4400) comprising a plurality of optical column opposite to a sample, wherein the optical column includes the inspection apparatus of claim 51, and a primary optical system of each of the optical column irradiates the sample with primary charged particles at a position of the sample which is different from that using the other lens barrel.

53. The inspection apparatus of claim 52 or 53 wherein the apparatus is constructed so that an energizing condition of an objective lens is obtained under a state where a pattern on a wafer is electrically charged.

54. An inspection apparatus (4400) adapted to irradiate a sample with a primary charged particles by a primary optical system, delivering secondary charged particles emitted from the sample by an E x B separator after the particles pass an objective lens into a secondary optical system, thereafter increasing a distance between secondary charged particle beams by at least one stage of lens, and detecting the secondary charged particle beams by a plurality of detectors,

wherein the objective lens comprises a first electrode to which a first voltage adjacent to an earth is applied and a second electrode to which a second voltage higher than the first voltage is applied, wherein a focal length of the objective lens is varied by changing the first voltage applied to the first electrode, and an

energizing means for energizing the objective lens comprises means for changing the voltage applied to the second electrode for changing significantly the focal length of the objective lens, and means for changing the voltage applied to the first electrode for changing the focal length in a short time.

55. A method for manufacturing semiconductor devices wherein a wafer during a manufacturing process or after processing is evaluated by using the inspection apparatus of any one of claims 51-54.

56. An inspection apparatus (4500) having a primary optical system and a secondary optical system, the primary optical system being arranged to convert a beam emitted from a single beam generating means into multi-beams by an aperture plate having a plurality of apertures, to reduce the multi-beams by an electrostatic lens of at least two stages, and to scan a sample to be inspected, and the secondary optical system being arranged to separate the secondary charged particle beams emitted from the sample from the first optical system by an E x B separator after passage through an electrostatic objective lens, to enlarge the secondary charged particle beams by an electrostatic lens of at least one stage, and to deliver the secondary charged particle beams to each of a plurality of detection devices;

wherein the sample is evaluated by at least two kinds of pixel dimensions so as to enable the sample to be evaluated in a mode in which throughput is high yet

resolution is relatively low and in a mode in which throughput is small yet resolution is high.

57. The inspection apparatus of claim 56, wherein a rate of reduction of the multi-beams in the primary optical system is associated with a rate of magnification in the electrostatic lens of the secondary optical system.

58. The inspection apparatus of claim 56, wherein a crossover image by the primary optical system is formed on a principal plane of an objective lens in the mode in which the throughput is high yet resolution is relatively low.

59. The inspection apparatus of claim 56, wherein the rate of magnification of the secondary optical system is adjusted by the electrostatic lens disposed at the detector side than an aperture aperture disposed in the secondary optical system.

60. A method for manufacturing devices, wherein a wafer being processed is evaluated by using the inspection apparatus of any one of claims 56 to 59.

61. An inspection apparatus (5000) comprising a primary optical system for generating primary charged particles, forcusing them, and irradiating a sample by scanning with the primary charged particles, a secondary optical system for receiving secondary charged particles emitted from portions of the sample where the primary charged particles are irradiated, and the secondary optical system having a lens of at least one stage and a detector for detecting the secondary primary charged particles,

wherein the secondary charged particles emitted from

the portions of the sample where the primary charged particles are irradiated are accelerated and are separated from the primary optical system by an E x B separator, and enter the secondary optical system, and an image the secondary charged particles is magnified by the lens and detected by a detector,

wherein the primary optical system generates a plurality of the primary charged particles and irradiates the sample concurrently therewith, and a plurality of the detectors is disposed so as to correspond to the number of the primary charged particles beams, a retarding voltage applying unit is disposed to apply a retarding voltage to the sample, and a charging investigating function for investigating a charging status of the sample is provided.

62. The inspection apparatus of claim 61, further comprising a function for determining an optimal retarding voltage on the basis of information relating to a charged-up state from the charging investigating function, and a function for applying the voltage to the sample or varying irradiation amount of the primary charged particles.

63. An inspection apparatus (5000) comprising an optical system for irradiating a sample with a plurality of charged particles and a charging investigating function, wherein the charging investigating function evaluates a distortion of a pattern or a fading of a pattern at a particular portion of the sample when secondary charged particles generated by irradiating the sample with primary electron beams are detected with a plurality of detectors to form an

image, and evaluates in such a way that a charging is large when the distortion of the pattern or the fading thereof is determined to be large.

64. The inspection apparatus of any one of claims 61 to 63, wherein the charging investigating function is arranged so that it is capable of applying a retarding voltage having a variable value to a sample, an image of a pattern in the vicinity of a boundary where a pattern density of the sample varies to a great extent is formed under a state where at least two retarding voltages are applied, and a display displays the image to enable an operator to evaluate a distortion of the pattern or a fading of the pattern is provided.

65. A method for manufacturing a device wherein a wafer during a process or after a process is evaluated by using the inspection apparatus of claim 64.

66. An E x B separator (6020) for forming an electric field and a magnetic field intersecting an optical axis at right angles and separating at least two charged particles having different travelling directions, comprising:

an electrostatic deflector having a pair of electrodes of a parallel flat plates for forming an electric field, an interval between the electrodes with each other being set so as to be shorter than a length of the electrode intersecting the electric field at right angles; and

an electromagnetic deflector of a toroidal type or a saddle type for deflecting the charged particles in the

direction opposite to the direction of deflection of the charged particles caused by the electrostatic deflector.

67. An E x B separator (6040) for forming an electric field and a magnetic field intersecting at right angles with an optical axis and separating at least two charged particles traveling in different directions, comprising:

an electrostatic deflector having at least six electrodes for forming a rotatable electric field; and

an electromagnetic deflector of a toroidal type or a saddle type for deflecting the charged particles in the direction opposite to the direction of deflection of the charged particles caused by the electrostatic deflector.

68. The E x B separator of claim 66 or 67, wherein the electromagnetic deflector of the toroidal type or the saddle type comprises two sets of electromagnetic coils for generating magnetic fields in both directions of electric fields and magnetic fields; and the direction of deflection caused by the electromagnetic deflector is set to become opposite to the direction of deflection caused by the direction of deflection by the electrostatic deflector by adjusting a rate of currents flowing through the two sets of the electromagnetic coils.

69. The E x B separator of claim 68, wherein the electrostatic deflector is disposed inside the electromagnetic deflector of the saddle type or the toroidal type.

70. An inspection apparatus (6000) for evaluating a processed state of a semiconductor wafer by irradiating the

semiconductor wafer with a plurality of primary charged particle, detecting the plurality of the secondary charged particles from the semiconductor wafer with a plurality of detectors, and obtaining image data, wherein the E x B separator of claim 68 is used for separating the secondary charged particles from the primary charged particles.

71. An inspection apparatus (7000) wherein a sample is placed on an XY-stage and charged particles are irradiated onto the sample, and wherein the XY-stage is contained in a housing and supported on the housing in a non-contact supporting state by a hydrostatic bearing, the housing which contains the stage is evacuated into a vacuum state, and a differential exhausting mechanism is provided around the portion of the inspection apparatus for irradiating charged particles onto a surface of the sample so as to evacuate an area of the sample where charged particles are irradiated.

72. The inspection apparatus of claim 71, wherein a gas to be fed to the hydrostatic bearing of the XY-stage is nitrogen or an inert gas, and the nitrogen or the inert gas is pressurized after being exhausted from the housing which contains the stage and is again supplied to the hydrostatic bearing.

73. An inspection apparatus for inspecting a defect on the surface of a semiconductor wafer by using the inspection apparatus of claim 71 or 72.

74. An exposure apparatus for delineating a circuit pattern of a semiconductor device on a surface of the

semiconductor wafer or a reticle by using the inspection apparatus of claim 71 or 72.

75. A method for manufacturing semiconductors by using the inspection apparatus of any one of claims 71 to 74.

76. A setting method for an inspection apparatus (8000), for reducing an aberration of a formed image in the inspection apparatus in which a plurality of charged particles is focused by a lens system including a condenser lens and then formed into an image on a sample by an objective lens, said method comprising the steps of:

varying a crossover position of the charged particles produced in the vicinity of the objective lens by the lens system, by adjusting the lens system measuring values of aberration in the formed image varying along with a variation of the crossover position;

identifying the crossover position corresponding to a range where the value of aberration is under a predetermined value, based on the measured values; and

setting the crossover position at the identified position by adjusting the lens system.

77. An inspection apparatus (8000) in which a plurality of charged particles is focused by a lens system including a condenser lens and then formed into an image on a sample by an objective lens, wherein a crossover position is set to such position where the values of aberration is under a predetermined value, which is determined by varying a crossover position by adjusting the lens system, and measuring values of aberration in the formed image varying

along with a variation of the crossover position.

78. The inspection apparatus of claim 77, wherein the crossover position is set taking a chromatic aberration of magnification as the aberration.

79. The inspection apparatus of claim 77, wherein the plurality of charged particles is a plurality of charged particles which is emitted from a single beam generating means and then passes through a plurality of apertures to be formed into the plurality of charged particles, a plurality of charged particles emitted from a plurality of beam generating means, or a plurality of charged particles emitted from a plurality of emitters formed in a single beam generating means.

80. The inspection apparatus of any one of claims 77 to 79, wherein the crossover position is set to a side of the lens system with respect to a principal plane of the objective lens.

81. A device manufacturing method for evaluating a wafer during manufacturing process by using the inspection apparatus of any one of claims 77 to 80.

82. An electron beam apparatus (5000) comprising a primary optical system for generating a primary electron beam, converging it, and irradiating a sample by scanning with the primary electron beam, a secondary optical system for receiving secondary electrons emitted from a portion of the sample where the primary electron beam is irradiated, said secondary optical system having a lens of at least one stage, and a detector for detecting the secondary electrons,

wherein the secondary electrons emitted from the portion of the sample where the primary electron beam is irradiated are accelerated and separated from the primary optical system by an E x B separator to be introduced into the secondary optical system, and an image of the secondary electrons is magnified by the lens to be detected by a detector, wherein

the primary optical system generates a plurality of the primary electron beams and irradiates the sample therewith concurrently, and a plurality of the detectors is disposed so that a number thereof corresponds to the number of the primary electron beams; and

the electron beam apparatus comprises a retarding voltage applying unit for applying an retarding voltage to the sample, and a charging investigating function for investigating a charged-up status of the sample, wherein an optimum retarding voltage is determined based on an information about the charging status from the charging investigating function, and then the optimum retarding voltage is applied to the sample or an irradiation amount of the primary electron beam is varied.

83. An inspection apparatus (4300) comprising a primary optical system having a single beam generating means for discharging a beam, an aperture plate with a plurality of apertures, a plurality of lenses, and an E x B separator so as to irradiate a surface of a sample to be inspected with the beam emitted from the beam generating means, and a secondary optical system for separating secondary charged

particles emitted from the sample from the primary optical system by the E x B separator so as to introduce them into a secondary charged particle detector to be detected therein; wherein

the beam from the beam generating means is irradiated onto the aperture plate to form an image of the plurality of apertures, a position of the image of the plurality of apertures is made to correspond to a position of the E x B separator, and a scanning voltage is superimposed on an electric field of the E x B separator so as to cause a deflecting operation of the beam.

84. An inspection method for inspecting an object to be inspected by irradiating the object to be inspected with either one of charged particles or an electromagnetic wave, wherein a working chamber controllable into a vacuum atmosphere for inspecting an object to be inspected, a beam generating means for generating either one of charged particles or an electromagnetic wave as a beam, an electronic optical system in which a plurality of the beams is irradiated onto the object held in the working chamber so as to be inspected and secondary charged particles generated from the object to be inspected are detected so as to introduce them into an image processing system, an image processing system for forming an image by the secondary charged particles, a data processing system for displaying and/or storing a state information of the object to be inspected based on an output from the image processing system, and a stage system for operatively

holding the object to be inspected so as to be movable with respect to the beam are provide, said inspection method comprising the steps of:

precisely positioning the beam on the object to be inspected by measuring a position of the object to be inspected;

deflecting the beam of either of charged particles or electromagnetic wave to a desired position on a surface of the measured object to be inspected;

irradiating the desired position on the surface of the object to be inspected with the beam;

detecting secondary charged particles generated from the object to be inspected;

forming an image by the secondary charged particles; and

displaying and/or storing a state information of the object to be inspected based on an output of the image processing system.

85. An inspection method (1000) for irradiating charged particles to a sample and for detecting secondary charged particles emitted from the sample,

wherein at least one primary optical system for irradiating the sample with a plurality of charged particle beams and at least one secondary optical system for leading the secondary charged particles to at least one detector are provided, and the plurality of the charged particle beams are irradiated with each spaced at a position greater than a distance resolution of the secondary optical system.

86. An inspection method (3000) for inspecting a sample for defects, comprising the steps of:

acquiring an image of a plurality of inspection regions that are displaced from each other while partially overlapping with each other on the surface of the sample;

storing a reference image; and

deciding a defect of the sample by comparing an image of each of the plurality of the inspection regions acquired in the step of acquiring with the reference image stored in the step of storing.

87. The inspection method of claim 86, wherein an electronic optical system (3100) comprising a source of particles for discharging primary charged particles and a deflecting means for deflecting the primary charged particles is provided, and

the plurality of the inspection regions are irradiated one after another with the primary charged particles by deflecting the primary charged particle with the deflecting means.

88. An inspection method (4100) comprising the steps of:

irradiating a beam emitted from a single beam generating means to an aperture plate with a plurality of apertures;

irradiating charged particles passed through the plurality of apertures to a sample by a primary optical system;

separating secondary charged particles generated from the sample from the primary optical system by an E x B

separator; and

delivering the separated secondary charged particles through a secondary optical system having at least one stage lens into a plurality of detectors so as to be detected.

89. An inspection method (4100) comprising the steps of: irradiating a beam emitted from a beam generating means with an integrated cathode to an aperture plate with a plurality of apertures;

focusing and irradiating beams passed through the plurality of apertures onto a sample surface by a primary optical system;

separating secondary charged particles generated from the sample from the primary optical system by an E x B separator; and

delivering the separated secondary charged particles through a secondary optical system having at least one stage lens and into a plurality of detectors so as to be detected.

90. An inspection method (4100) comprising the steps of:

delivering a plurality of images of apertures to a sample, said plurality of images of apertures being produced by irradiating a beam emitted from a beam generating means onto an aperture plate having a plurality of apertures; and

separating secondary charged particles generated from the sample from a primary optical system to be delivered into a secondary optical system, and enlarging the

secondary charged particles by the secondary optical system to be projected onto a surface of a detector;

said method further comprising:

disposing a single aperture plate in a position deviated toward the side of the beam generating means from a position of an image of the beam generating means formed by a lens of the primary optical system; and

disposing the position of the single aperture plate in the direction of an optical axis thereof so as to minimize a difference in beam strength of the beams to be delivered from each aperture to the surface of the sample.

91. An inspection method (4100) comprising the steps of:

delivering a plurality of images of apertures onto a sample, said plurality of images of apertures being produced by irradiating a beam emitted from a beam generating means to an aperture plate having a plurality of apertures; and

separating secondary charged particles generated from the sample from a primary optical system to be delivered into a secondary optical system, and enlarging the secondary charged particles by the secondary optical system to be projected to a surface of a detector;

wherein a single aperture plate is disposed in a position deviated toward the side of the beam generating means from a position of an image of the beam generating means formed by a lens of the primary optical system; and

an amount of deviation is set such that an amount of detection of the secondary charged particles obtained when

a sample with no pattern is disposed on a surface of the sample minimizes a difference thereof between the plurality of the apertures.

92. An inspection method (4200) comprising the steps of: irradiating a first multi-aperture plate having a plurality of apertures with beams emitted from one or more beam generating means;

projecting and scanning a reduced image of primary charged particles passed through the plurality of the apertures onto a sample by using a primary optical system; and

enlarging secondary charged particles emitted from the sample, by a secondary optical system to detect them by a detector having a plurality of detecting elements; and

disposing a second multi-aperture plate with a plurality of apertures in front of the detector;

wherein positions of the apertures formed in the second multi-aperture plate are arranged so as to correct a distortion of the secondary optical system.

93. An inspection method (4300) comprising the steps of:

providing a primary optical system comprising a single beam generating means for discharging a beam, an aperture plate with a plurality of apertures, a plurality of lenses, and an E x B separator, so as to irradiate a surface of a sample to be inspected with the beam emitted from the beam generating means; and

separating secondary charged particles emitted from the sample from the primary optical system by the E x B

separator so as to introduce them into a secondary charged particle detector to be detected therein;

wherein the beam from the beam generating means is irradiated onto the aperture plate to form an image of the plurality of apertures, and a scanning voltage is superimposed on an electric field of the E x B separator so as to cause a deflecting operation of the beam.

94. An inspection method (4400) comprising the steps of:

irradiating a sample with a plurality of primary charged article beams by a primary optical system; and

delivering secondary charged particles emitted from the sample, after having passed through an objective lens, into a secondary optical system by an E x B separator, thereafter increasing a distance between secondary charged particle beams by at least one stage of lens, and detecting the secondary charged particle beams by a plurality of detectors;

wherein at least three different energizing voltages are separately supplied to the objective lens so as to take at least three data measurements which represent rising widths of electric signals corresponding to strength of the secondary charged particles and which are obtained when a pattern edge parallel with a first direction is scanned in a second direction.

95. An inspection method (4400) comprising the steps of:

irradiating a sample with a plurality of primary charged particles by a primary optical system; and

delivering secondary charged particles emitted from

the sample, after having passed through an objective lens, into a secondary optical system by an E x B separator, thereafter enlarging a distance between secondary charged particle beams by at least one stage of lens, and detecting the secondary charged particle beams by a plurality of detectors;

wherein the objective lens comprises a first electrode to which a first voltage near earth is applied and a second electrode to which a second voltage higher than the first voltage is applied, and a focal length of the objective lens is varied by changing the first voltage applied to the first electrode; and

an energizing means for energizing the objective lens comprises a means for changing the voltage applied to the second electrode for significantly changing the focal length of the objective lens, and a means for changing the voltage applied to the first electrode for changing the focal length in a short time.

96. An inspection method (4500) comprising the steps of:

converting a beam emitted from a single beam generating means into multi-beams by an aperture plate having a plurality of apertures;

reducing the multi-beams by an electrostatic lens of at least two stages by a primary optical system, and scanning a sample to be inspected; and

separating the secondary charged particle beams emitted from the sample, after having passed through an electrostatic objective lens, from the first optical system

by an E x B separator, thereafter enlarging the secondary charged particle beams by an electrostatic lens of at least one stage, and delivering the secondary charged particle beams to a plurality of detection devices;

wherein the sample is evaluated by at least two kinds of pixel dimensions so as to enable the sample to be evaluated in a mode in which throughput is high yet a resolution is relatively low and also in another mode in which throughput is small yet resolution is high.

97. An inspection method (5000) comprising the steps of:

providing a primary optical system for generating primary charged particles, converging them, and irradiating a sample by scanning with the primary charged particles, and a secondary optical system for receiving secondary charged particles emitted from portions of the sample where the primary charged particles are irradiated, said secondary optical system having a lens of at least one stage; and

accelerating the secondary charged particles emitted from the portions of the sample where the primary charged particles are irradiated, separating the secondary charged particles from the primary optical system by an E x B separator so as to enter the secondary optical system, and magnifying an image of the secondary charged particles by the lens to be detected by a detector; said method further comprising the steps of:

generating a plurality of the primary charged particles by the primary optical system and irradiating the

sample concurrently therewith;

providing a plurality of the detectors so that the number thereof corresponds to that of the primary charged particles beams;

applying a retarding voltage to the sample; and

investigating a charged-up status of the sample.

98. An inspection method using an apparatus (5000) comprising an optical system for irradiating a sample with a plurality of charged particles and a charging investigating function, wherein the charging investigating function evaluates a distortion of a pattern or a fading of a pattern at a specific portion of the sample when secondary charged particles generated by irradiating the sample with primary charged particles are detected by a plurality of detectors to form an image, and evaluates a charging to be large when the distortion of the pattern or the fading thereof is determined as large.

99. An inspection method (7000) for irradiating a sample placed on an XY-stage with charged particles, wherein the XY-stage is contained in a housing and supported on the housing in a non-contact supporting state by a hydrostatic bearing, the housing which contains the stage is evacuated into a vacuum state, and a differential exhausting mechanism is provided around a portion of the inspection apparatus for irradiating the charged particles to a surface of the sample so as to evacuate an area of the sample where charged particles are to be irradiated.

100. An inspection method (4300) comprising the steps of:

providing a primary optical system comprising a single beam generating means for discharging a beam, an aperture plate provided with a plurality of apertures, a plurality of lenses and an E x B separator so that the beam from the beam generating means is irradiated onto a surface of a sample; and

separating secondary charged particles emitted from the sample from the primary optical system by the E x B separator so as to enter a secondary charged particle detecting device to be detected thereby;

wherein the beam from the beam generating means is irradiated onto the aperture plate to form an image of the plurality of apertures, a position of the image of the plurality of apertures is made to correspond to a position of the E x B separator, and a scanning voltage is superimposed on an electric field of the E x B separator so as to deflect the beam.